OPERATING SUMMARY

# DUNNVILLE (REGIONAL) water treatment plant

# 1967



ONTARIO WATER RESOURCES COMMISSION

Division of Plant Operations

ONTARIO WATER RESOURCES COMMISSION

OFFICE OF THE GENERAL MANAGER

Members of the Dunnville Local Advisory Committee,
Dunnville, Ontario.

Gentlemen:

We are happy to present you with the 1967 Operating Summary for the Dunnville Regional Water Treatment Plant, OWRC Project No. 6-0017-58.

Your co-operation with our staff throughout the year has been appreciated.

Yours very truly,

D. S. Caverly,
General Manager.



#1

ONTARIO WATER RESOURCES COMMISSION
801 BAY STREET
TORONTO 5

TELEPHONE 365-

J. A. VANCE, LL.D.
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J. H. H. ROOT, M.P.P.
VICE-CHAIRMAN

D. S. CAVERLY
GENERAL MANAGER

W. S. MacDONNELL
COMMISSION SECRETARY

General Manager,
Ontario Water Resources Commission.

Dear Sir:

I am pleased to submit to you the 1967 Operating Summary for the Dunnville Regional Water Treatment Plant, OWRC Project No. 6-0017-58.

The summary reviews progress during the year, outlines operating problems encountered and summarizes in graphs, charts and tables all significant flow and cost data.

Yours very truly,

D. A. McTavish, P. Eng.,
Director,
Division of Plant Operations.

# FOREWORD

● This operating summary has been prepared in order to acquaint readers with the management of the project during 1967. The efficiency of the plant's operation is reflected in a general review. Significant financial details are recorded, and technical performance is illustrated by graphs and charts.

The summary should answer two salient questions. Are the project's facilities adequate at this time? And can the project meet future requirements?

The Regional Operations Engineer is primarily responsible for the preparation of the report, and will be pleased to answer any questions regarding it.

Most of the material for the graphs and charts was compiled by the statistics section of the Division of Plant Operations, with the final versions of the graphs being drawn by the draughting section of the Division of Sanitary Engineering. Cost data were provided by the Division of Finance.

It will be evident from the report that all of these groups co-operated with substantial success.

# CONTENTS

# DUNNVILLE REGIONAL
## water treatment plant

operated for

THE TOWN OF DUNNVILLE

SHERBROOKE METALLURGICAL COMPANY LIMITED

THE ELECTRIC REDUCTION COMPANY LIMITED

by the

ONTARIO WATER RESOURCES COMMISSION

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Assistant Director: C. W. Perry
Regional Supervisor: A. C. Beattie
Operations Engineer: R. S. McKittrick

801 Bay Street Toronto 5

# '67 REVIEW

The total output of treated water during the past year was 3,714.05 million gallons for an average daily plant output of 10.18 million gallons. This is a slight decrease over the average daily flow in 1966 of 10.42 million gallons.

The total operating cost per 1000 gallons was 2.84 cents as opposed to 2.60 cents in 1966 and the total cost, which includes operating, interest on the capital debt, debt retirement and reserve fund charges was 8.47 cents per 1000 gallons as opposed to 8.12 cents per 1000 gallons in 1966.

The study initiated in 1966 to investigate specific deficiencies within the plant, i.e., frazil ice, low lift pump capacity, travelling water screens high lift pump controls and participant metering, was completed in 1967 and the results were presented to the Local Advisory Committee. The Committee chose at that time to defer any action on recommendations within the report until future flow requirements were accurately determined.

Damage sustained in 1966 by the plant sub-station and secondary cables was completely repaired in 1967. All secondary cables were replaced and the costs for repair were split between the project and the insurance company.

The fourth low lift pump was installed during 1967 under the previous arrangement whereby the cost of this unit would be paid from the reserve account until such time as a new project is initiated to deal with more extensive modifications to the plant.

# PROJECT COSTS

Long Term Debt to OWRC - (Revised Estimated)

| | | |
|---|---|---|
| Dunnville | $ 546,880.86 | |
| Electric | $1,109,956.28 | |
| Sherbrooke | $ 911,769.49 | |
| | | $2,568,606.63 |

Debt Retirement Balance at Credit (Sinking Fund) December 31, 1967

| | | |
|---|---|---|
| Dunnville | $ 92,395.44 | |
| Electric | $ 189,582.82 | |
| Sherbrooke | $ 156,065.90 | |
| | | $ 438,044.16 |

The total cost to the participant during 1967 was as follows:

| | | |
|---|---|---|
| Net Operating | | |
| Dunnville | $ 19,621.76 | |
| Electric | 47,083.78 | |
| Sherbrooke | 38,674.46 | $ 105,380.00 |
| Debt Retirement | | |
| Dunnville | $ 11,038.61 | |
| Electric | 22,405.08 | |
| Sherbrooke | 18,404.58 | $ 51,848.27 |
| Reserve | | |
| Dunnville | $ 2,750.73 | |
| Electric | 5,403.37 | |
| Sherbrooke | 4,450.28 | $ 12,604.38 |
| Interest Charged | | |
| Dunnville | $ 30,833.81 | |
| Electric | 62,580.04 | |
| Sherbrooke | 51,413.82 | $ 144,827.67 |
| TOTAL | | $ 314,660.32 |

## RESERVE ACCOUNT

| | | |
|---|---|---|
| Balance at January 1, 1967 | | |
| Dunnville | $16,918.98 | |
| Electric | 43,859.22 | |
| Sherbrooke | 34,876.52 | $ 95,654.72 |
| Deposited by Participant | | |
| Dunnville | $ 2,750.73 | |
| Electric | 5,403.37 | |
| Sherbrooke | 4,450.28 | $ 12,604.38 |
| Interest Earned | | |
| Dunnville | $ 987.97 | |
| Electric | 2,473.44 | |
| Sherbrooke | 2,013.46 | $ 5,474.87 |
| Less Expenditures | | |
| Dunnville | $ 3,535.82 | |
| Electric | 9,837.38 | |
| Sherbrooke | 6,991.76 | $ 20,364.96 |
| Balance at December 31, 1967 | | |
| Dunnville | $17,121.86 | |
| Electric | 41,898.65 | |
| Sherbrooke | 34,348.50 | $ 93,369.01 |

# MONTHLY OPERATING COSTS

| MONTH | TOTAL EXPENDITURE | PAYROLL | CASUAL PAYROLL | FUEL | POWER | CHEMICAL | GENERAL SUPPLIES | EQUIPMENT | REPAIRS & MAINTENANCE | SUNDRY | WATER |
|---|---|---|---|---|---|---|---|---|---|---|---|
| JAN | 7,828.18 | 3065.53 | | 158.64 | 2993.48 | (17.50) | 84.26 | 95.90 | 1347.17 | 100.70 | |
| FEB | 6,840.92 | 3068.20 | | 146.38 | 3094.33 | | 84.74 | 161.37 | 207.90 | 78.00 | |
| MARCH | 7,211.88 | 5243.73 | | 152.94 | 2831.53 | 1103.38 | 159.08 | 440.73 | (3250.37) | 530.86 | |
| APRIL | 11,888.69 | 3123.47 | | 139.07 | 5581.58 | | 190.05 | 442.59 | (158.83) | 2585.76 | (15.00) |
| MAY | 10,140.11 | 3435.56 | 183.89 | 95.01 | 5575.68 | | 208.70 | | 484.16 | 157.11 | |
| JUNE | 5,162.35 | 3347.75 | 263.22 | 81.91 | (1843.92) | 22.81 | 162.18 | 891.32 | 19.69 | 2217.39 | |
| JULY | 8,968.87 | 3260.92 | 274.26 | 4.99 | 3368.68 | 980.00 | 158.59 | 28.71 | 471.56 | 442.37 | (21.21) |
| AUG | 8,076.62 | 3456.48 | 251.66 | | 3050.93 | | 125.86 | 651.25 | 477.96 | 62.48 | |
| SEPT | 10,137.50 | 4961.20 | 381.64 | | 3649.13 | | 162.83 | | 897.99 | 84.71 | |
| OCT | 7,276.54 | 3272.82 | 225.86 | 8.92 | 2985.43 | 60.00 | 490.40 | | 165.96 | 89.90 | (22.75) |
| NOV | 9,457.20 | 3440.32 | | 58.36 | 2985.63 | (98.63) | 309.44 | 493.00 | 234.50 | 2034.58 | |
| DEC | 12,391.14 | 3265.88 | | 60.24 | 2865.23 | 975.00 | 489.06 | 829.22 | 3722.43 | 199.52 | (15.44) |
| TOTAL | 105,380.00 | 42941.86 | 1580.53 | 906.46 | 37137.71 | 3025.06 | 2625.19 | 4034.09 | 4620.12 | 8583.38 | (74.40) |

BRACKETS INDICATE CREDIT

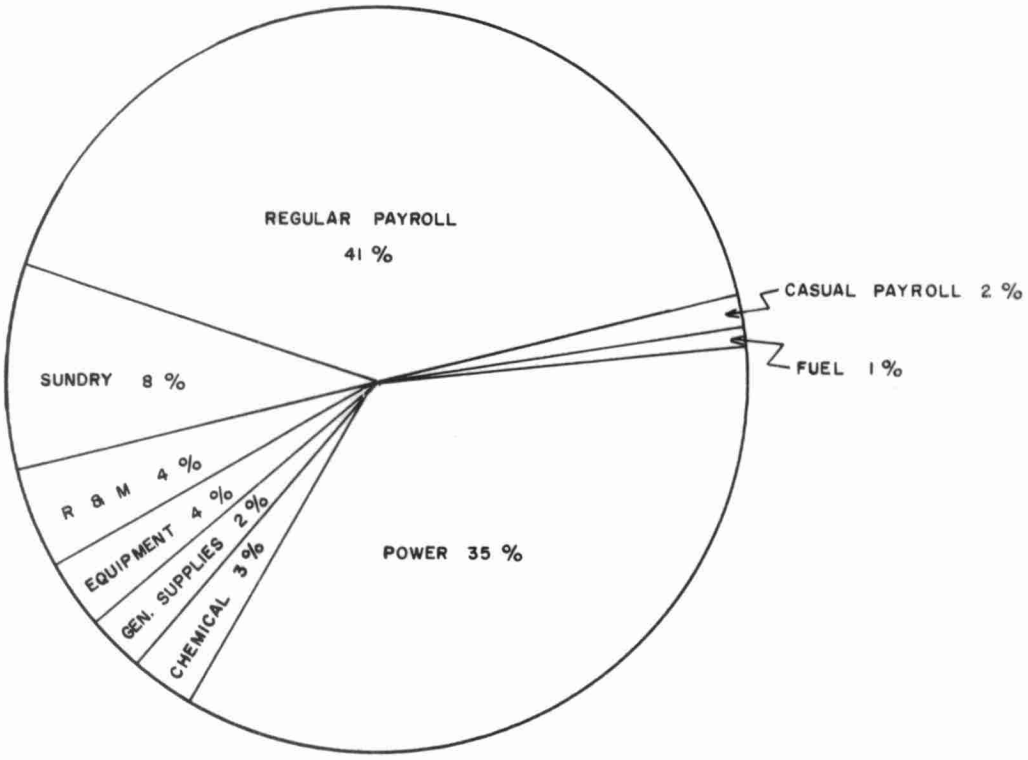
## SUMMARY OF WATER COSTS

| Year | M. G. Treated | Operating Cost | Operating Cost per 1,000 gallons | Total Cost | Total Cost per 1,000 gals. |
|---|---|---|---|---|---|
| 1961 | 2245.838 | $ 71,428.00 | 3.18¢ | $276,047.37 | 12.29¢ |
| 1962 | 3214.853 | 85,564.88 | 2.66¢ | 297,494.48 | 9.25¢ |
| 1963 | 3726.935 | 95,458.82 | 2.56¢ | 309,179.48 | 8.29¢ |
| 1964 | 3719.568 | 99.095.96 | 2.66¢ | 312,663.35 | 8.40¢ |
| 1965 | 3692.889 | 98,485.34 | 2.67¢ | 311,630.93 | 8.44¢ |
| 1966 | 3802.109 | 98,983.63 | 2.60¢ | 308,574.01 | 8.12¢ |
| 1967 | 3714.052 | 105,380.00 | 2.84¢ | 314,660.32 | 8.47¢ |

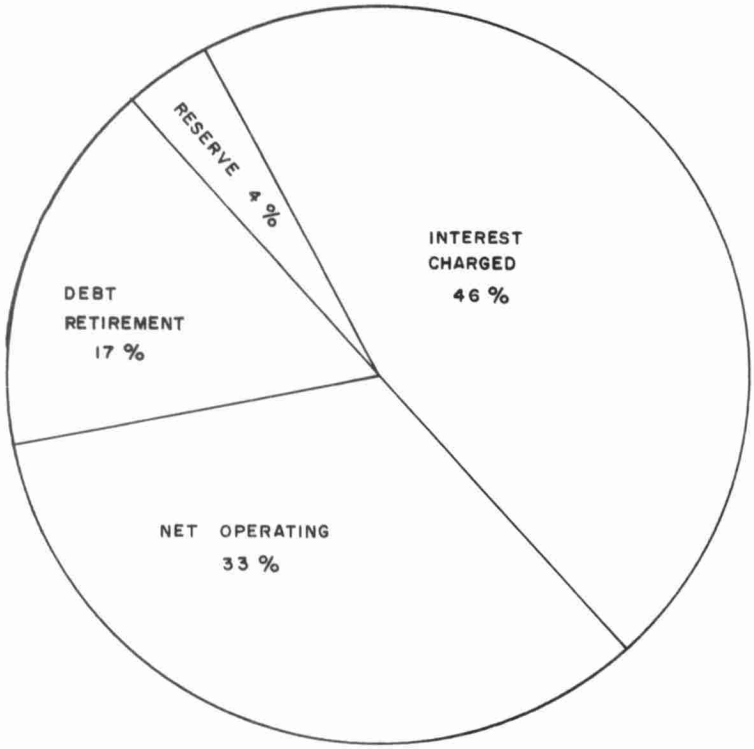
## COST TO EACH PARTICIPANT IN 1967

| Participant | M. G. Used | Operating Cost | Operating Cost per 1.000 gallons | Total Cost | Total Cost per 1,000 gals. |
|---|---|---|---|---|---|
| Town of Dunnville | 423.802 | 19,621.76 | 4.63¢ | 64,244.91 | 15.16¢ |
| Electric Reduction | 1769.768 | 47,083.78 | 2.66¢ | 137,472.27 | 7.77¢ |
| Sherbrooke Metallurgical | 1520.482 | 38,674.46 | 2.54¢ | 112,943.14 | 7.43¢ |

## 1967 OPERATING COSTS




## TOTAL ANNUAL COST



# Process Data

## GENERAL

The treatment of water at the Dunnville plant consists of microstraining to remove such things as algae and gross solids, and disinfection by the addition of chlorine. The following data provide information regarding the output of the plant, the quality of raw water, the quality of the treated water and chlorine dosages necessary to maintain safe water. The quality of the water is discussed using such terms as filterability and turbidity. An effort is made to define the meaning of these terms and graphs have been drawn to indicate the frequency of occurrence of various readings.

## FLOW

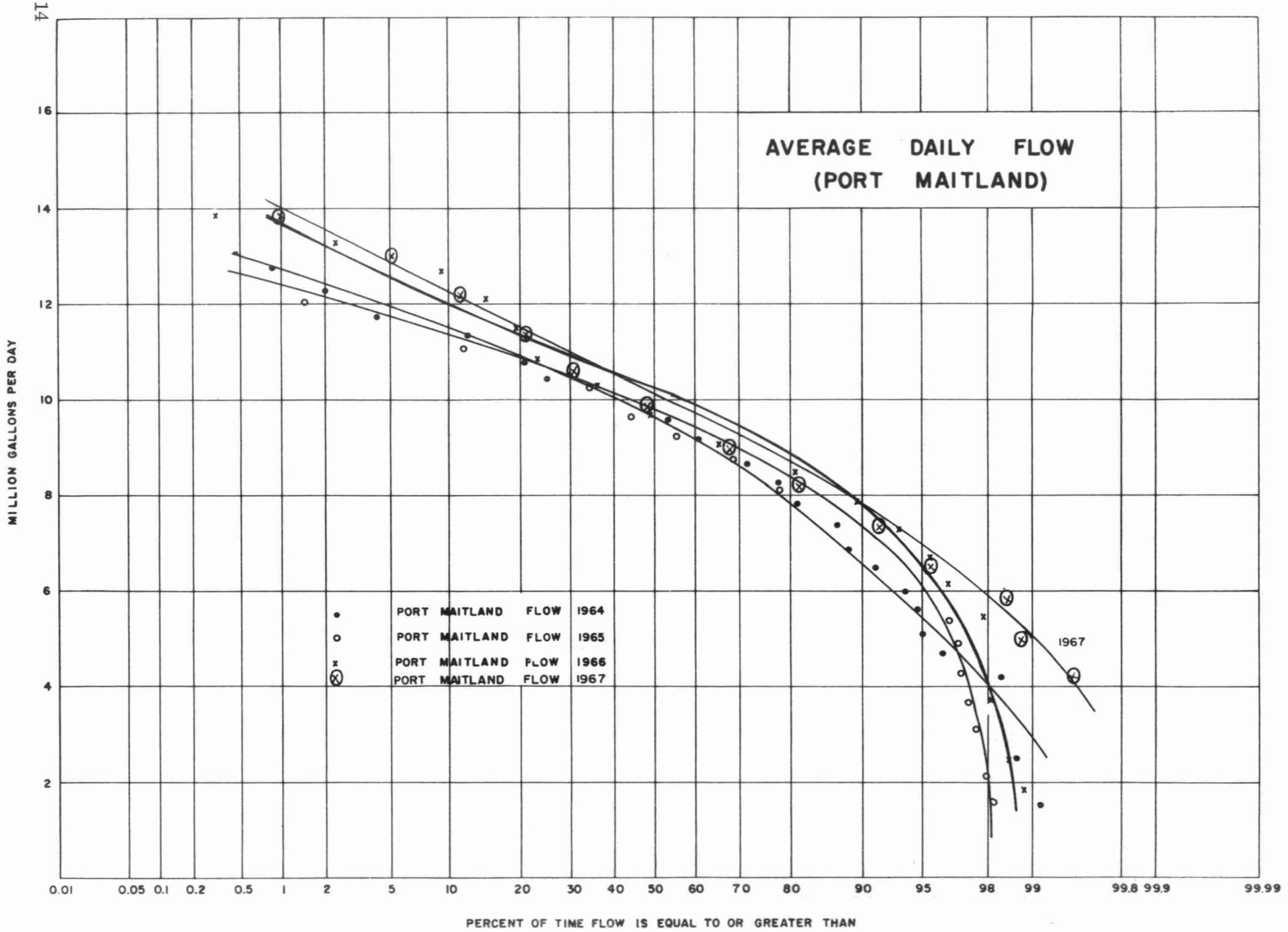
A total of 3,714.05 million gallons of treated water was pumped to the industries in Port Maitland and the Town of Dunnville in 1967. Total flow to the Town of Dunnville was up 22.8 percent, Electric Reduction was up 14.2 percent and Sherbrooke Metallurgical was down 20.2 percent from 1966 figures. The net result was a decrease in total plant flow of 2.4 percent in relation to the 1966 total flow.

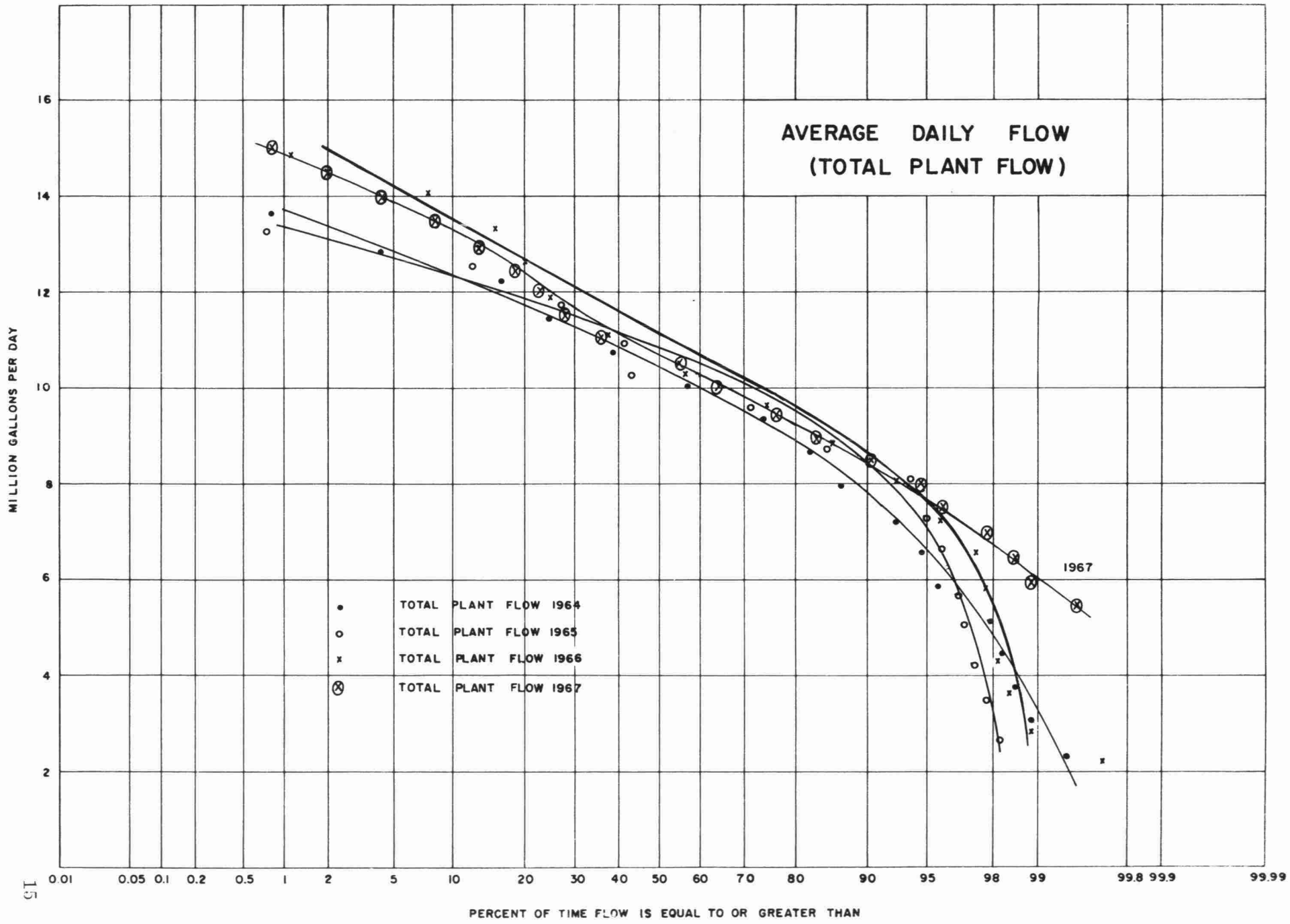
The following two charts and three graphs provide details and highlights of the flow pattern for the year.

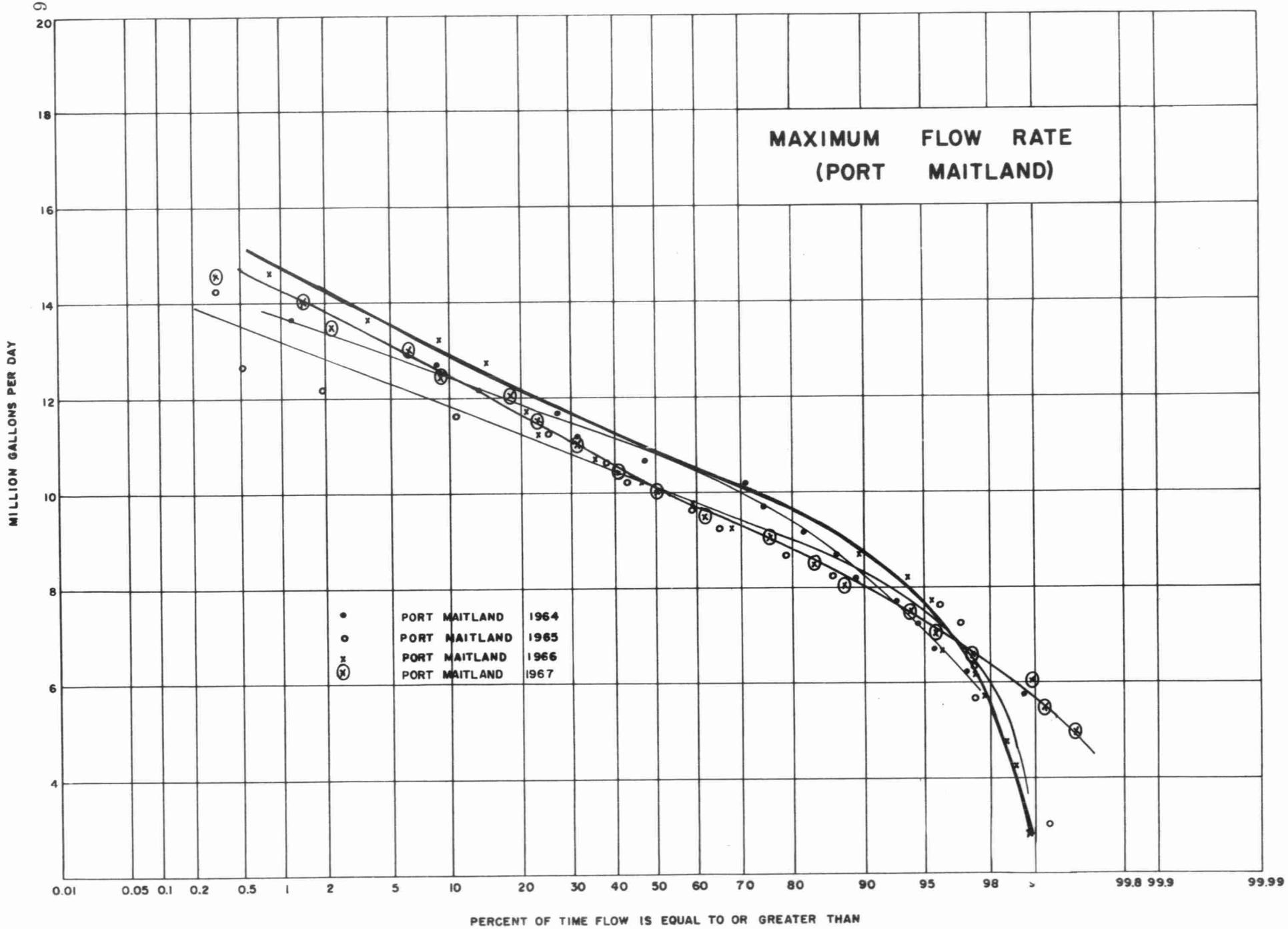
## 1967 FLOW HIGHLIGHTS

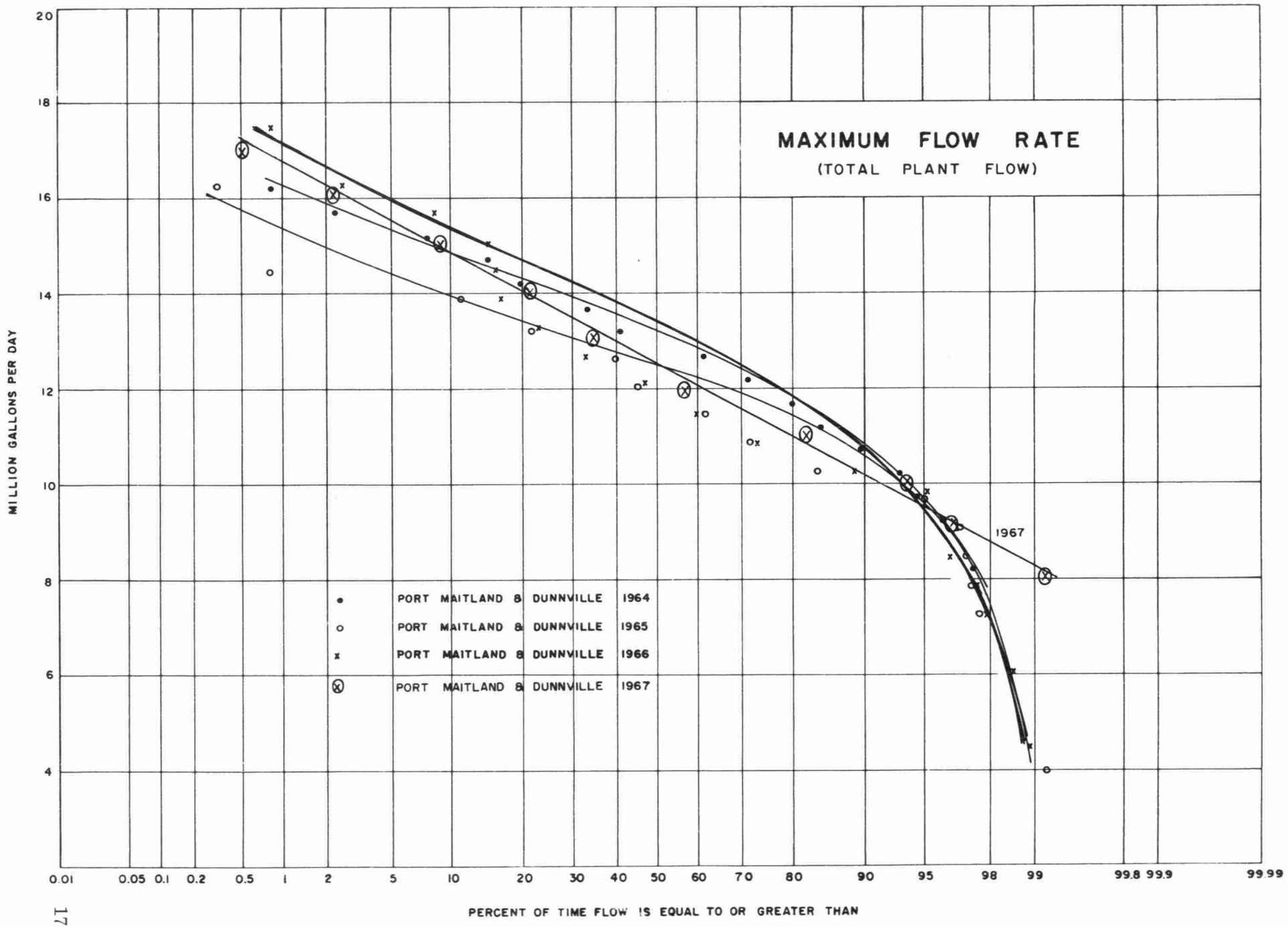
| DESCRIPTION | PLANT | | DUNNVILLE | | INDUSTRIES | |
|---|---|---|---|---|---|---|
| | DATE | FLOW** | DATE | FLOW ** | DATE | FLOW ** |
| Max. Avg. Mthly. | Aug. | 12.40 | Feb. | 1.47 | Aug. | 11.20 |
| Min. Avg. Mthly. | Dec. | 8.35 | April | 0.83 | Dec. | 7.18 |
| Max. Avg. Weekly | Aug. 14-20 | 13.96 | Feb. 20-26 | 1.60 | Aug. 14-20 | 12.61 |
| Max. Daily | Aug. 18 | 14.74 | Mar. 1 | 1.67 | Aug. 20 | 13.52 |
| Min. Daily * | July 21 | 4.09 | Mar. 5 | 0.58 | July 21 | 3.30 |
| Max. Instantaneous Flow rate | Aug. 20 | 16.72 | Aug. 20 | 2.88 | Aug. 18 | 14.42 |

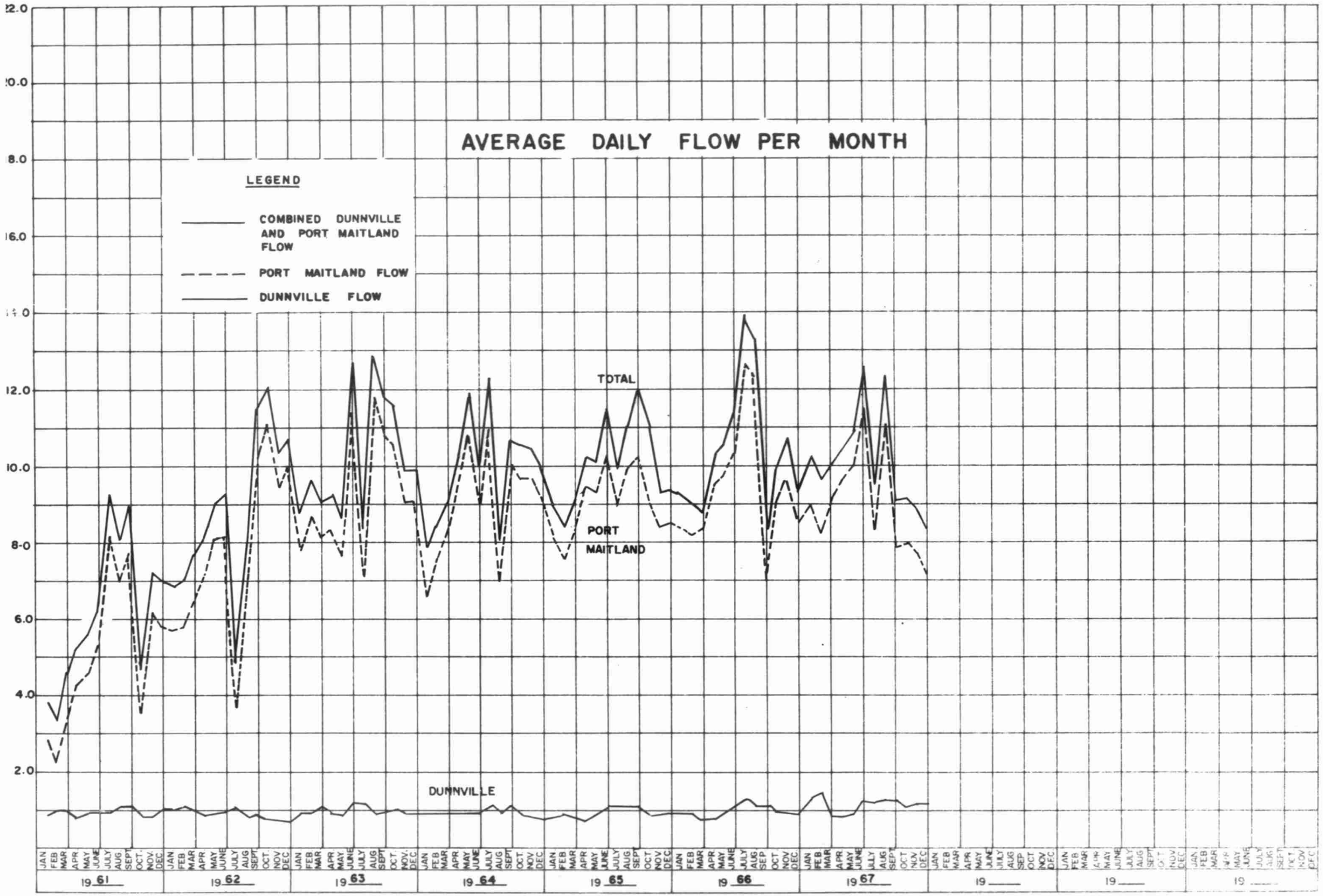
* Plant shut-down for connection of new secondary power cables at sub-station and main panel.
** All flows in million gallons per day.


AVERAGE DAILY FLOW
(PORT MAITLAND)
MILLION GALLONS PER DAY
16
14
12
10
8
6
4
2
PORT MAITLAND FLOW 1964
PORT MAITLAND FLOW 1965
PORT MAITLAND FLOW 1966
PORT MAITLAND FLOW 1967
1967
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.8 99.9 99.99
PERCENT OF TIME FLOW IS EQUAL TO OR GREATER THAN


AVERAGE DAILY FLOW
(TOTAL PLANT FLOW)
MILLION GALLONS PER DAY
16
14
12
10
8
6
4
2
TOTAL PLANT FLOW 1964
TOTAL PLANT FLOW 1965
TOTAL PLANT FLOW 1966
TOTAL PLANT FLOW 1967
1967
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.8 99.9 99.99
PERCENT OF TIME FLOW IS EQUAL TO OR GREATER THAN

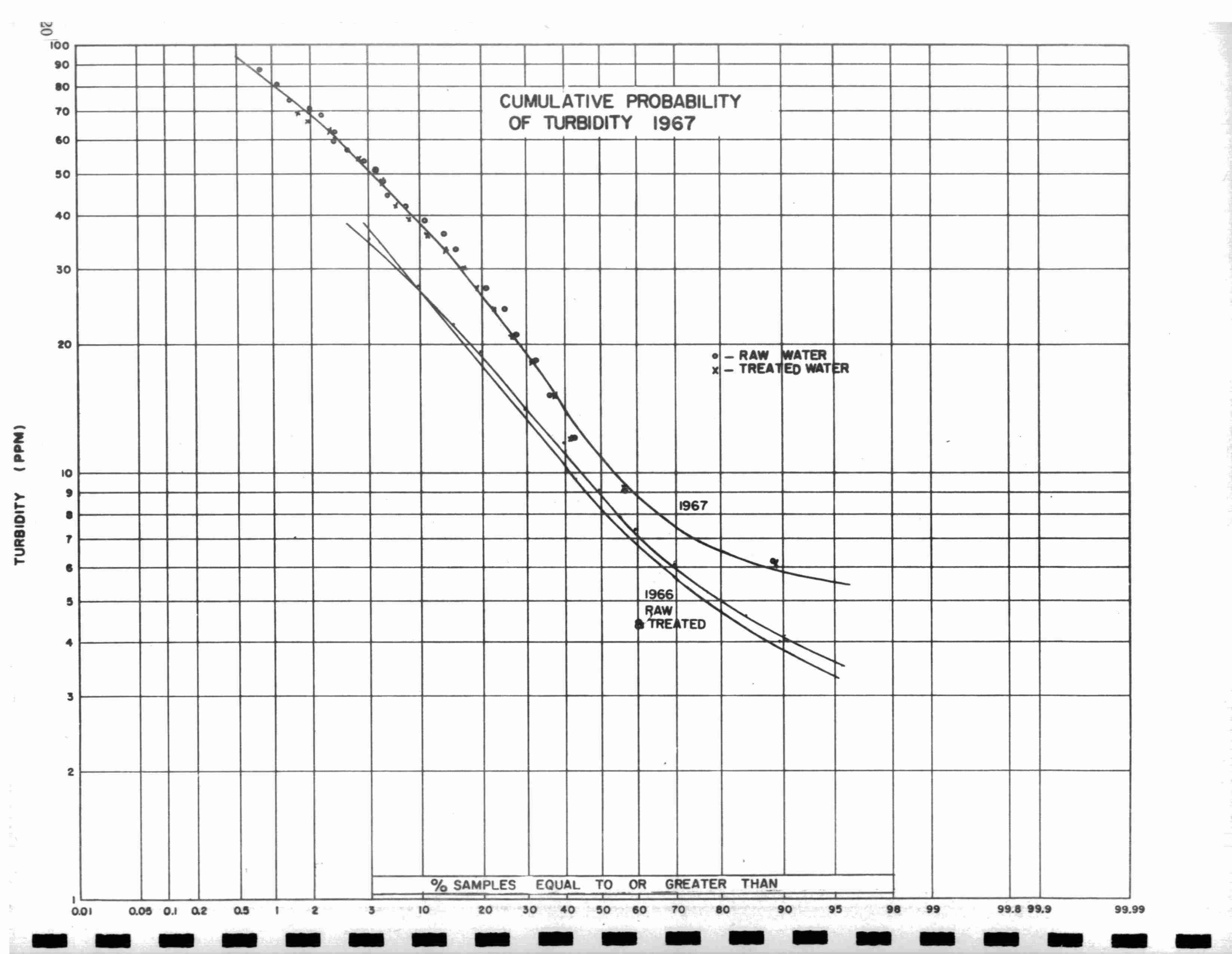

MAXIMUM FLOW RATE
(PORT MAITLAND)
MILLION GALLONS PER DAY
20
18
16
14
12
10
8
6
4
PORT MAITLAND 1964
PORT MAITLAND 1965
PORT MAITLAND 1966
PORT MAITLAND 1967
0.01
0.05
0.1
0.2
0.5
1
2
5
10
20
30
40
50
60
70
80
90
95
98
99.8
99.9
99.99
PERCENT OF TIME FLOW IS EQUAL TO OR GREATER THAN


MAXIMUM FLOW RATE
(TOTAL PLANT FLOW)
MILLION GALLONS PER DAY
PERCENT OF TIME FLOW IS EQUAL TO OR GREATER THAN
PORT MAITLAND & DUNNVILLE 1964
PORT MAITLAND & DUNNVILLE 1965
PORT MAITLAND & DUNNVILLE 1966
PORT MAITLAND & DUNNVILLE 1967
1967
20
18
16
14
12
10
8
6
4
0.01
0.05
0.1
0.2
0.5
1
2
5
10
20
30
40
50
60
70
80
90
95
98
99
99.8
99.9
99.99


AVERAGE DAILY FLOW PER MONTH
LEGEND
COMBINED DUNNVILLE AND PORT MAITLAND FLOW
PORT MAITLAND FLOW
DUNNVILLE FLOW
TOTAL
PORT MAITLAND
DUNNVILLE
12.0
10.0
8.0
6.0
4.0
2.0
JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT. NOV. DEC
19 61
19 62
19 63
19 64
19 65
19 66
19 67
19 ____

## FLOW DATA

| Month | Total Flow MG | Dunnville Town MG | Electric Reduction MG | Sherbrooke Metallurgical MG |
|---|---|---|---|---|
| January | 320.238 | 41.008 | 129.412 | 149.818 |
| February | 272.150 | 41.040 | 111.317 | 119.793 |
| March | 313.304 | 27.434 | 130.955 | 154.915 |
| April | 315.192 | 24.922 | 134.527 | 155.743 |
| May | 340.550 | 29.190 | 134.099 | 177.261 |
| June | 381.764 | 37.234 | 145.792 | 198.738 |
| July | 297.367 | 37.387 | 163.135 | 96.845 |
| August | 384.636 | 39.046 | 178.648 | 166.942 |
| September | 275.430 | 38.350 | 154.526 | 82.554 |
| October | 285.303 | 35.493 | 171.783 | 78.027 |
| November | 268.815 | 35.805 | 159.776 | 73.244 |
| December | 259.303 | 36.893 | 155.808 | 66.602 |
| Total | 3,714.052 | 423.802 | 1,769.768 | 1,520.482 |
| % of Total | 100.0 | 11.4 | 47.7 | 40.9 |
| Average Daily | 10.175 | 1.161 | 4.849 | 4.166 |


CUMULATIVE PROBABILITY
OF TURBIDITY 1967
TURBIDITY (PPM)
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
4
3
2
1
o — RAW WATER
x — TREATED WATER
1967
1966
RAW
TREATED
% SAMPLES EQUAL TO OR GREATER THAN
0.01
0.05
0.1
0.2
0.5
1
2
3
10
20
30
40
50
60
70
80
90
95
98
99
99.8
99.9
99.99

## TURBIDITY

The turbidity of water is a measure of the interference presented by suspended matter to the passage of light. This measurement therefore indirectly measures the suspended matter such as clay, silt, finely divided organic matter and microscopic organisms present in the water.

The microstrainers at the Dunnville Regional Treatment plant are designed to remove only the larger micro-organisms, particularly algae. It can be seen from the accompanying graph on turbidity measurements that the treatment process does not significantly reduce the turbidity of the raw water. It may be deduced from these results that the major source of turbidity in the raw water is caused by substances smaller than can be removed by the microstrainers.

The OWRC standard for drinking water specifies a turbidity limit of 1 ppm. This standard was never achieved.

## BACTERIOLOGICAL ANALYSIS

A total of 191 samples were submitted to the OWRC Laboratory for bacteriological analysis in 1967. Of these, 42 samples were of raw water taken at the low lift station and 149 were of chlorinated water collected from the end of the Dunnville and Port Maitland mains and either Grandview school or Camp Goforth in Dunn Township. Of the 149 chlorinated samples, 144 were classed as grade A or satisfactory, 2 were grade B water where the pollution present is not sufficient to regard as unfit for drinking, and 3 were grade C or water where pollution present has made the water unsafe for human consumption. However, in cases such as this when a small percentage of the total samples were grade C, it is common to assume that the sample was contaminated during the sampling procedure. Resampling is always conducted to assure that no contamination actually exists.

## CHEMICAL ANALYSIS

A total of 35 samples of treated water were submitted to the OWRC laboratory for chemical analysis in 1967. Approximately the same number of samples of raw water were also submitted for analysis. There is virtually no change between treated and raw water due to the dissolved nature of the chemicals and the yearly average values listed below may be considered as applicable to either raw or treated water. Also included in the table below are normally accepted standards for good quality water.

| Description | Hardness as $CaCO_3$ (PPM) | Alkalinity as $CaCO_3$ (PPM) | Iron as Fe (PPM) | Chloride as Cl (PPM) | pH at Lab | Colour in Hazen Un. | Phenols in (ppb) | Sulphates as $SO_4$ (PPM) | Flourides in (PPM) |
|---|---|---|---|---|---|---|---|---|---|
| Standards | < 100 | 30 to 100 | <. 03 | < 350 | 6. 7 to 8. 5 | < 5 | < 2 | < 250 | < 1. 2 |
| (Yearly Avg.) Dunnville Plant | 148 | 108 | 0. 78 | 27 | 8. 2 | 5 | 1 | 27 | 0. 1 |

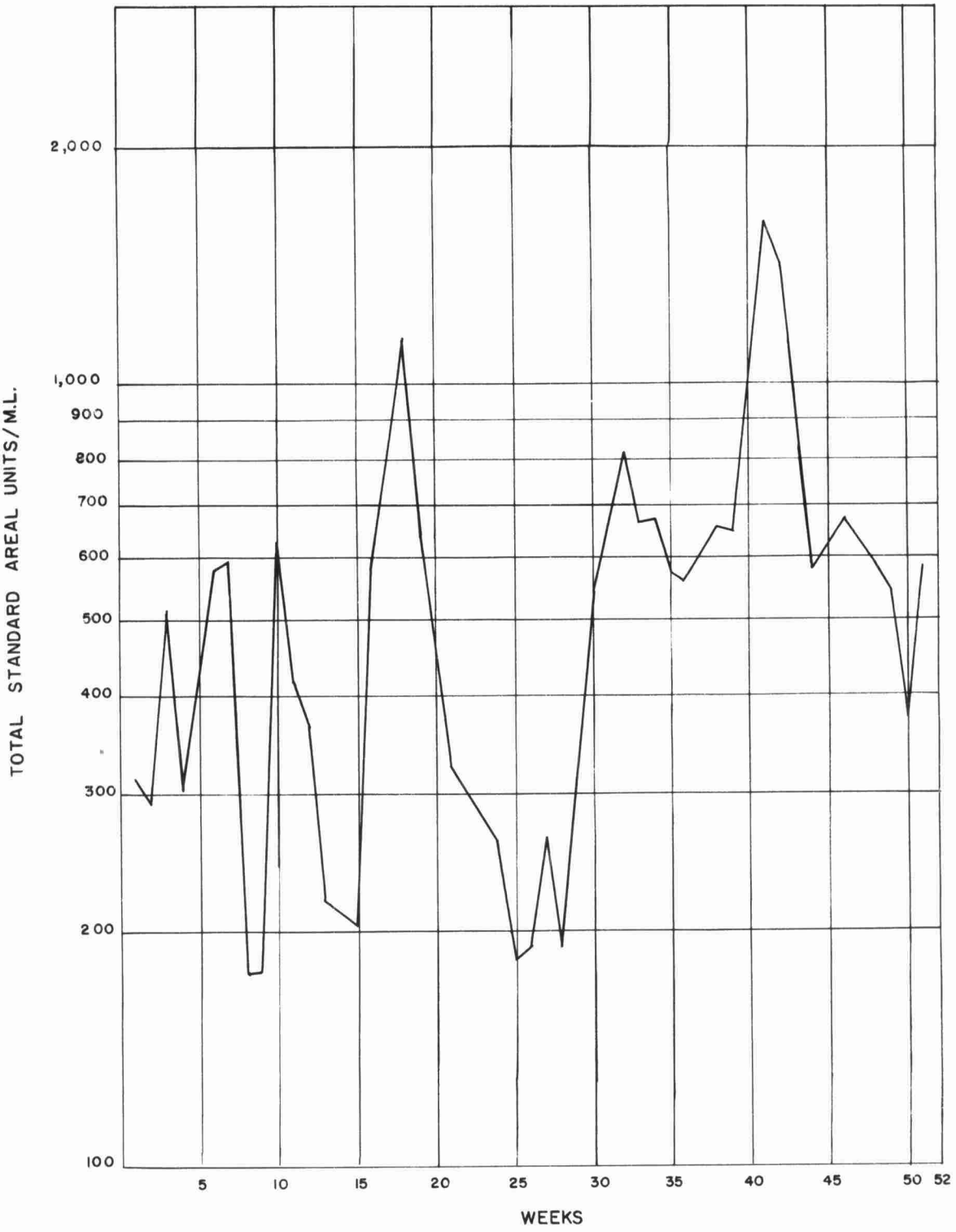
## ALGAE ENUMERATION AND IDENTIFICATION (see graph)

Algae, in addition to their ability to cause obnoxious tastes and odours, may modify the pH, alkalinity, colour, turbidity and radioactivity of the water. Corrosive activity of the water is often increased as a result of algae growth. Although there is no record of pathogenic species of algae toxic to humans, there are algae which produce toxic organic substances causing the death of wild and domestic animals. Algae have been regarded with some suspicion in cases of a general outbreak of gastro-intestinal disorders among persons using a common water supply.

Most of the algae of importance in water supplies may be categorized into four general groups, the greens, blue greens, diatoms and flagellates. The enumerations performed at the Dunnville plant have revealed that the greatest portion of algae in this area of the lake came from the greens and diatoms. Microstrainers at the plant are successful in removing a great proportion of the algae in the raw water.

The accompanying graph shows the seasonal variations of algae in the raw water.

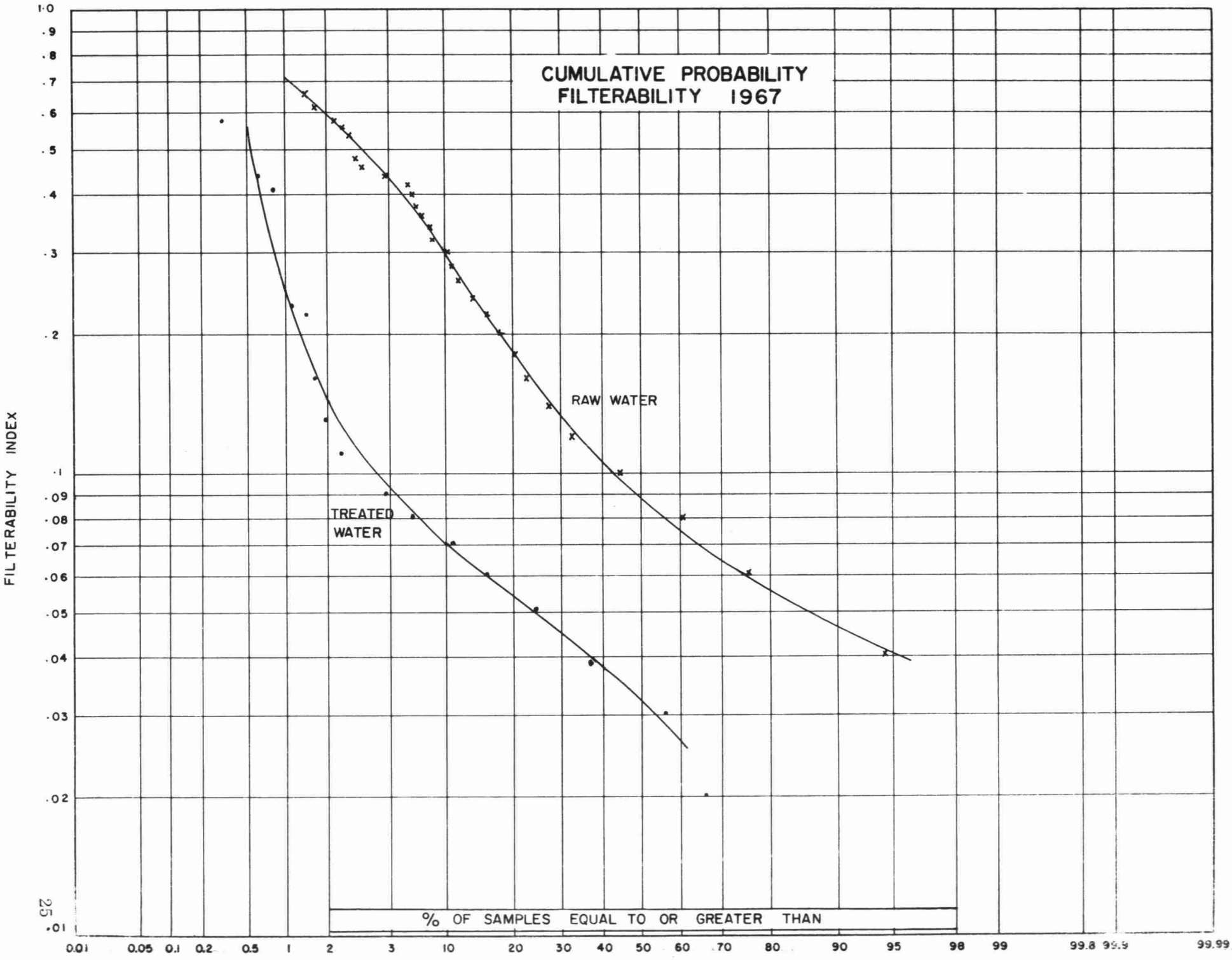
# ALGAE ENUMERATION RESULTS
## 1967
( RAW WATER )



## FILTERABILITY

The filterability index has been developed in connection with microstrainers in order to measure their ability to filter water. The index is affected by the type of microstrainer fabric used and the quality, particularly turbidity, of the water to be filtered.

For a given fabric an increase in the index indicates a poorer quality of water which decreases the capacity of the microstrainers. For a given quality of water the index will increase with an increase in the fineness of the microstrainer fabric. The microstrainers at the plant are equipped with Mark I fabric having an aperture opening of 35 microns with 80,000 apertures per square inch.


CUMULATIVE PROBABILITY
FILTERABILITY 1967
RAW WATER
TREATED WATER
FILTERABILITY INDEX
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
.09
.08
.07
.06
.05
.04
.03
.02
.01
% OF SAMPLES EQUAL TO OR GREATER THAN
0.01
0.05
0.1
0.2
0.5
1
2
3
10
20
30
40
50
60
70
80
90
95
98
99
99.8
99.9
99.99

## CHLORINATION

| MONTH | PLANT FLOW (MG) | POUNDS CHLORINE | DOSAGE RATE (P.P.M) |
|---|---|---|---|
| JANUARY | 320.238 | 2796 | .87 |
| FEBRUARY | 272.150 | 2266 | .83 |
| MARCH | 313.304 | 2538 | .81 |
| APRIL | 315.192 | 3369 | 1.07 |
| MAY | 340.550 | 3471 | 1.02 |
| JUNE | 381.764 | 4116 | 1.08 |
| JULY | 297.367 | 3418 | 1.15 |
| AUGUST | 384.636 | 3908 | 1.02 |
| SEPTEMBER | 275.430 | 2927 | 1.06 |
| OCTOBER | 285.303 | 3101 | 1.09 |
| NOVEMBER | 268.815 | 2750 | 1.02 |
| DECEMBER | 259.303 | 2810 | 1.08 |
| TOTAL | 3,714.052 | 3,7470 | 12.10 |
| AVERAGE | 10.175 | 3123 | 1.01 |

# CONCLUSIONS

The Dunnville Regional Water Supply System operated effectively during 1967, treating a total flow for the year of 3,714.05 million gallons. Repairs were completed to the secondary feeder cables and a fourth low lift pump was installed providing complete flexibility in the low lift pumping station.

Ice blockage in the plant intake again resulted in down time for the industrial consumers during 1967. Algae was again a problem during the warmer summer months.

# RECOMMENDATIONS

1. It is strongly recommended that action be taken on the installation of travelling water screens in the low lift pumping station. During periods of slush ice or heavy algae, it is frequently necessary to raise the manually cleaned screens partially, to meet the water demand. This has, in the past, resulted in severe damage to one low lift pump and minor damage to several others. In addition, it frequently resulted in overtime for plant staff as the one operator on duty cannot cope with the raw water screen situation and continue to operate the rest of the plant.

2. It is recommended that the special consultant's proposal for enlargement of the intake crib ports and installation of immersion heaters, to alleviate ice blockage, be accepted and arrangements finalized to proceed with this work as soon as possible.